The West Coast Regional Report

THE COMMERCIAL HARVESTING SECTOR

The fisheries off California, Oregon, and Washington involve a wide variety of species and several different types of fishing gear. Table 4-l provides an overview of participation in west coast fisheries, and shows the ex-vessel revenues and landings per vessel. This table reflects all domestic west coast commercial, nontribal landings, including catch from this region that did not occur within the EEZ.

Throughout the period 1984-93, highly variable prices and revenue potential in many non-groundfish fisheries encouraged most full-time fishing vessels operating off the west coast to develop diversified fishing strategies. Most of the major west coast fisheries, other than groundfish, are subject to cyclical or erratic fluctuations in total value. In the important salmon, shrimp, tuna, and crab fisheries, it is not uncommon for annual revenue to increase by 40-100% or decrease by 25-70% from one season to the next. Sometimes these fluctuations are the result of changes in abundance or availability, while in other years dramatic price changes are responsible.

Although groundfish have represented a generally more stable source of income than other species, groundfish prices and income potential have frequently been more modest than in some of the other fisheries. As a result, abundance and prices in the salmon, shrimp, tuna, and crab fisheries have traditionally played an important role in determining the level of fishing effort directed towards groundfish. This interdependence between fisheries emphasizes the need for management strategies that recognize the potential impact of regulation in one fishery on others.

Because of the general lack of effective limited entry programs for west coast fisheries, high prices or abundance in any given year in a particular fishery tend to draw many new or previous participants into the "booming" fishery. The cycle of participation is sometimes seasonal, with vessels moving from one target fishery to another throughout the year. In other cases, vessels react to longer term changes in stock abundance or prices by shifting effort towards or away from certain fisheries for a given year. During periods without a "boom" fishery, many marginal participants exit from fishing entirely. These observations are, by necessity, very general in nature. As a result of limited data availability and staffing resources, the relationships involved in west coast product demand or vessel participation have rarely been quantitatively examined.

Figure 4-l shows a breakdown of the number of vessels harvesting in west coast fisheries between 1984 and 1993. A distinction is made between those vessels whose landed catch exceeded three different threshold amounts- 1 pound, 2 metric tons (t), and 25 t. Over 90% of the vessels landed less than 25 t each year; approximately 60% of the vessels landed less than 2 t.

In general, west coast vessels with a higher level of production are characterized by a greater degree of diversity in their fishing operations. As one measure of diversity, the number of different fisheries in which a vessel participated is considered. Of approximately 26,800 unique vessels participating in west coast fisheries between 1984 and 1993,68% had less than 10 t of landings. Of these, 95% participated in fewer than three fisheries. In contrast, of the remaining 32% of vessels

West coast fishing vessels near Fishermen's Terminal, Seattle (NMFS photo by Joni Packard).

(i.e., those with more than 10 t of landings), only 43% participated in fewer than three fisheries, and 24% had landings in at least five fisheries. In addition to the diversity that is reflected in vessels' participation in multiple west coast fisheries, some segments of this fleet, such as hook and line boats and offshore delivery vessels, also participate in fisheries off the coast of Alaska.

Management

The Pacific Fishery Management Council (PFMC) currently oversees three FMP's that govern fisheries for groundfish, salmon, and anchovies. The groundfish FMP includes various species of flatfish, rockfish, and groundfish, such as sablefish and Pacific whiting. The salmon plan focuses upon chinook and coho stocks that breed in freshwater streams from northern California to the Canadian border. The annual percentages of salmon and groundfish taken in PFMC-managed waters are shown in Figure 4-2. Discussions of developments specific to these two FMP groups are provided in the following two sections. The anchovy fishery is minor, accounting for less than 4,000 t in landings and less than $1 million in annual ex-vessel revenues since 1984. Because of the small magnitude of this fishery, and considerations of funding, mandated regulatory reduction, and need, the Council is currently considering abandoning this FMP.

Groundfish

The west coast groundfish fishery has undergone several major changes since the implementation of the MFCMA. Prior to 1979, most of the groundfish caught off the west coast was harvested by foreign fishing vessels (Fig. 4-3). The principal targets for most foreign operations were either Pacific ocean perch or Pacific whiting, an abundant, low unit-value pelagic species. Both species are now managed under the PFMC's Groundfish FMP. By 1979, foreign and domestic catches were roughly the same, though domestic landings consisted of generally higher-valued species. Following implementation of the MFCMA, an increasing percentage of west coast groundfish was caught by domestic vessels. Initially, much of this new domestic effort came in the form of joint-venture arrangements with foreign processing ves-

Table 4-1

Average annual ex-vessel revenue per vessel in real dollars (1987=100), landings per vessel in round weight (pounds), real ex-vessel price, and number of vessels participating in west coast fisheries, for all vessels with some landings in the specified west coast species group, 1984-93[1].

Species	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Groundfish										
Revenue	7,058	7,324	7,043	7,411	6,975	6,471	6,212	7,362	7,171	7,189
Landings	26,146	24,750	22,107	20,839	21,051	21,613	21,715	24,129	24,354	25,720
Prices	0.27	0.30	0.32	0.36	0.33	0.29	0.28	0.31	0.30	0.28
Vessels	7,822	8,458	9,055	10,547	9,932	10,398	9,796	8,740	8,683	7,721
Whiting										
Revenue	7,807	14,867	10,319	17,141	20,611	25,130	20,326	31,561	95,162	46,739
Landings	153,935	309,323	216,726	349,881	344,096	495,665	398,403	709,054	2,414,531	1,877,187
Prices	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.04	0.04	0.02
Vessels	96	94	119	111	85	69	52	73	53	50
Salmon										
Revenue	5,014	5,879	7,273	11,843	14,605	6,559	5,824	4,446	3,553	3,972
Landings	3,129	5,261	5,660	6,733	7,150	5,471	3,995	5,204	3,534	5,206
Prices	1.60	1.11	1.29	1.76	2.04	1.20	1.46	0.86	1.01	0.76
Vessels	5,867	7,908	7,945	7,396	7,301	7,415	6,594	5,829	4,141	4,149
Crab										
Revenue	16,059	17,388	16,290	16,181	22,589	20,911	23,125	11,317	18,860	21,604
Landings	9,877	11,817	11,861	12,133	20,101	20,150	17,434	8,888	19,639	23,898
Prices	1.63	1.47	1.37	1.33	1.13	1.04	1.33	1.27	0.96	0.91
Vessels	1,706	1,701	1,657	1,822	2,004	1,919	1,936	1,877	1,872	1,728
Shrimp										
Revenue	18,459	33,141	72,220	95,928	60,406	59,586	55,621	42,674	54,605	31,236
Landings	32,379	81,129	126,815	138,204	144,452	169,075	121,227	84,717	175,572	99,362
Prices	0.57	0.41	0.57	0.69	0.41	0.35	0.46	0.50	0.31	0.32
Vessels	332	351	466	498	501	472	467	527	459	526
Shellfish										
Revenue	16,155	5,917	8,728	9,110	7,463	8,463	12,295	12,792	37,166	38,061
Landings	21,299	3,571	3,696	14,620	14,246	8,019	12,890	13,079	15,509	15,371
Prices	0.76	1.65	2.36	0.62	0.52	1.05	0.95	0.98	2.40	2.48
Vessels	238	531	237	388	378	532	324	302	154	215
Coastal pelagic										
Revenue	26,613	20,208	27,867	18,476	20,768	17,229	9,501	18,794	10,221	8,496
Landings	296,816	238,945	353,716	279,865	284,282	257,260	172,751	309,779	172,489	192,282
Prices	0.09	0.08	0.08	0.07	0.08	0.06	0.05	0.06	0.06	0.04
Vessels	414	426	341	446	454	529	613	323	507	336
Tuna										
Revenue	58,613	24,853	38,870	85,220	92,251	82,801	37,814	40,194	21,176	24,857
Landings	119,249	60,712	88,694	86,369	98,915	93,813	49,700	55,739	32,828	41,592
Prices	0.49	0.41	0.43	0.99	0.93	0.88	0.76	0.72	0.65	0.60
Vessels	1,524	1,156	772	974	836	620	809	362	867	822
Sea urchin										
Revenue	18,911	22,776	33,748	30,614	34,714	40,307	39,536	51,658	46,127	43,642
Landings	71,634	90,297	116,474	106,650	99,003	97,227	83,691	78,317	61,631	52,814
Prices	0.26	0.25	0.29	0.29	0.35	0.41	0.47	0.66	0.74	0.83
Vessels	216	229	307	471	657	652	672	739	718	682
Squid										
Revenue	5,048	25,355	32,013	29,791	52,590	55,270	38,832	58,427	20,863	68,977
Landings	19,989	144,948	321,452	331,261	569,998	771,366	580,613	930,018	292,100	792,955
Prices	0.25	0.18	0.10	0.09	0.10	0.07	0.07	0.06	0.07	0.09
Vessels	111	166	146	133	144	117	108	89	99	119
Herring										
Revenue	6,173	17,357	14,709	15,683	14,845	12,399	27,538	27,357	26,434	4,472
Landings	18,782	37,923	41,608	48,193	48,735	52,697	57,813	54,700	52,244	38,860
Prices	0.33	0.46	0.35	0.33	0.31	0.24	0.48	0.50	0.50	0.11
Vessels	403	416	425	417	435	423	318	331	304	252
Pacific halibut										
Revenue	5,415	12,572	14,704	13,320	14,036	17,169	6,992	5,561	3,065	4,299
Landings	5,852	9,663	8,462	6,115	8,266	10,047	3,128	2,287	1,845	2,674
Prices	0.92	1.30	1.73	2.18	1.69	1.71	2.23	2.43	1.66	1.61
Vessels	239	273	367	365	261	224	201	206	218	294
Other										
Revenue	8,180	10,146	9,409	7,978	7,239	8,189	6,852	6,065	6,084	6,611
Landings	6,650	8,747	8,153	6,015	5,732	6,707	7,021	5,475	5,942	4,822
Prices	1.23	1.17	1.16	1.33	1.26	1.22	0.97	1.10	1.03	1.37
Vessels	2,678	2,379	2,511	2,607	2,700	2,623	2,526	2,377	2,349	2,183

[1]Included are landings of fish caught inside state waters, but not catch by recreational or tribal fishermen. Source: Redefined PacFIN data base, Seattle Office of the Pacific States Marine Fisheries Commission, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115-0070.

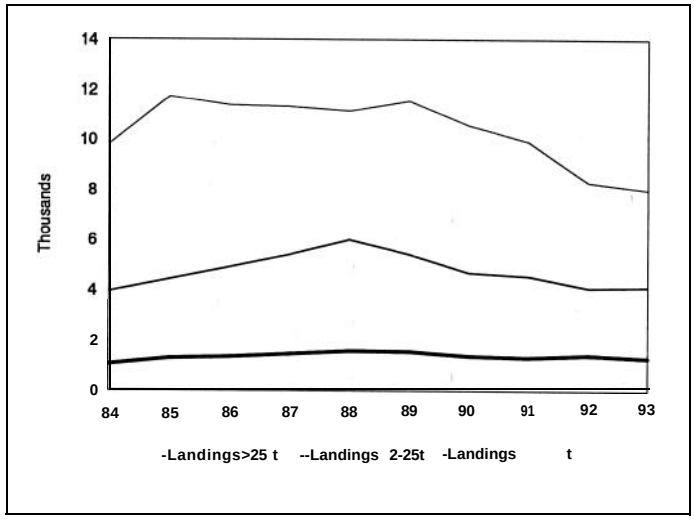


Figure 4-l
Number of west coast vessels, by landings category.

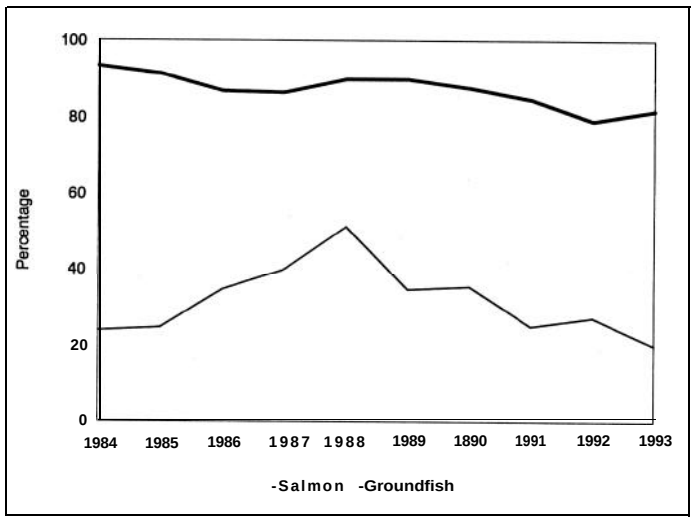


Figure 4-2
Percentage of Pacific coast salmon and groundfish caught in PPMC-managed areas (includes only commercial, non-tribal shoreside landings).

sels. Following exploratory fishing for Pacific whiting by a few U.S. factory trawlers in 1990, the rapid entry of many domestic factory trawlers and motherships in 1991 rendered foreign processing unnecessary for the harvest of more than 200,000 t of whiting. As shown in Figures 4-3 and 4-4, the foreign fleet, which had processed at least 150,000 t of whiting during each of the previous 5 years, was provided with no further allocation for processing any species after 1990.

West coast factory trawler near Fishermen's Terminal, Seattle (NMFS photo by Joni Packard).

After 5 years of development by the PFMC, a license limitation program was implemented in 1994 for the west coast groundfish fishery. Individual transferable quotas were not considered at length for the groundfish fishery as a whole because of identified problems in implementing them in a multi-species trawl fishery without observers routinely aboard vessels. Permits were issued to individuals based on the catch history of their vessels, and included gear and vessel-length eligibility. Gears endorsed for use in the program were trawl, longline, and pot. The program allows permits to be combined, according to a formula, in order to facilitate the permitting of large vessels.

Alongside the limited entry fishery for groundfish, the PFMC elected to maintain an open-access fishery, open to any previously legal groundfish gear except trawls. The allocation of particular species to the open access fishery is based on the percentage of landings during the qualifying window by vessels not qualifying for permits. In addition to pot and longline gear, most of these fish are caught with other line gears, set nets, or with shrimp trawling gear.

From 1984 to 1993, the annual number of vessels landing groundfish peaked at 4,364 in 1987, and has declined steadily since then to 2,850. However, this trend is more indicative of the reduction in the size of the salmon fleet, which has accompanied reductions in salmon quotas since 1988, than it is of reductions in the most productive ranks of the groundfish fleet. Within the three limited entry gear groups, the number of vessels landing more than 1 t of groundfish has stayed roughly the same for those using trawl or pot gear, but has doubled for those using line gear. This upward trend for line-gear vessels is apparent for

threshold levels as high as 25 t of annual landings. However, at a threshold of 50 t of landings, the number of vessels has declined for all gears since 1987, primarily due to reductions in availability of some economically important species.

While the number of vessels fishing for groundfish has not, on the whole, increased dramatically over the last 10 years, the combination of increases in vessel harvesting capacity and the fishing down of some key stocks to or below MSY levels has led to greater difficulty in managing and participating in the groundfish fishery.

For the trawl fishery, the PFMC has established an objective of maintaining a year-round fishery. This objective reflects the need for processors to maintain a domestic fresh-market presence with many species, as well as concerns regarding social and employment stability in coastal communities. In an attempt to extend fishing opportunities throughout the year, the PFMC has recommended an elaborate system of trip/landing limits designed to restrict vessel output. These limits have evolved from very rudimentary single-species limits on individual trips to the current restrictions that take the form of cumulative monthly limits, some of which relate single species catch to that of a larger assemblage. Following the recent implementation of a means of controlling entry into this fishery, the PFMC has begun to consider possibilities for individuals to gain access to multiple monthly limits through the purchase of additional permits.

No factory trawlers were initially issued permits under the license limitation program, because the qualifying window predated their involvement in the fishery. And despite the fact that nine factory trawlers now have permits, obtained through the purchase of roughly 100 trawl permits (out of 390), both the whiting fishery and those for other groundfish species remain highly overcapitalized. The offshore fleet, which harvested roughly 180,000 t in 1994, has demonstrated the ability to catch at least 35,000-40,000 t of whiting per week. In the remaining groundfish fishery, many trawlers reach their cumulative limits by fishing only 2 weeks per month throughout much of the year. These statistics provide some evidence that license limitation programs (or limited entry) alone cannot prevent overcapitalization.

Pot gear is used in the groundfish fishery primarily to target sablefish, which is also the principal target for a large segment of the longline fleet.

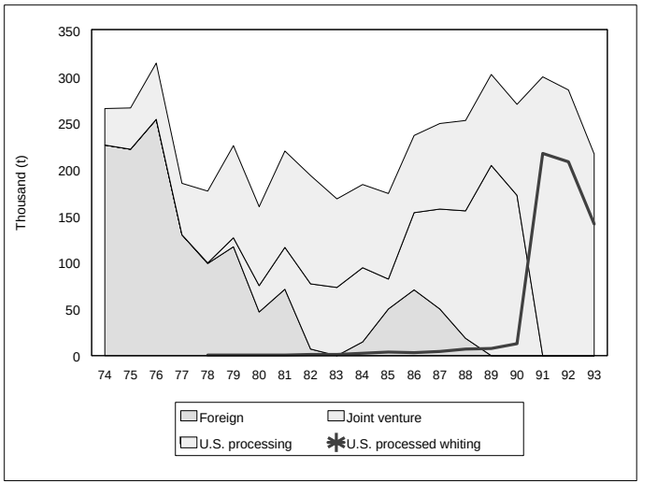


Figure 4-3
Catch of Pacific coast groundfish (includes discards from foreign, joint venture, and U.S. at-sea processors, but not catch from tribal or recreational fishers).

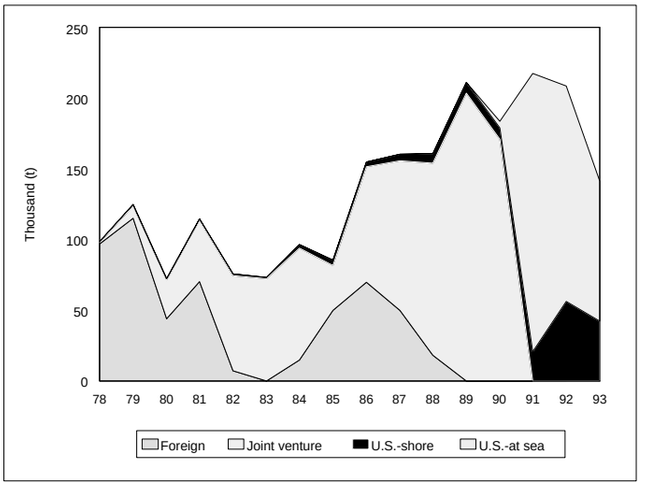


Figure 4-4
Catch of Pacific whiting (includes discards from foreign, joint venture, and U.S. at-sea processors, but not catch from tribal or recreational fishers). 1993 data are preliminary.

Because this fish is predominantly exported in frozen form, providing a year-round fishery was not a high management priority. Although the sablefish season was open year-round in 1984, by 1992 the fixed-gear (pot and longline) season for sablefish had been reduced to roughly 2 weeks. And despite reducing the number of participants from more than 300 to about 120, license limitation in 1994 was only successful in adding 1 week to the

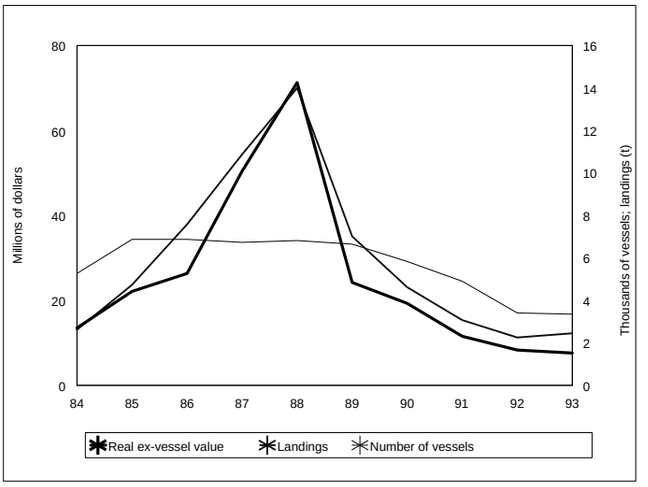


Figure 4-5
Ex-vessel value, landings, and number of vessels harvesting chinook salmon (includes landings of fish caught inside state waters).

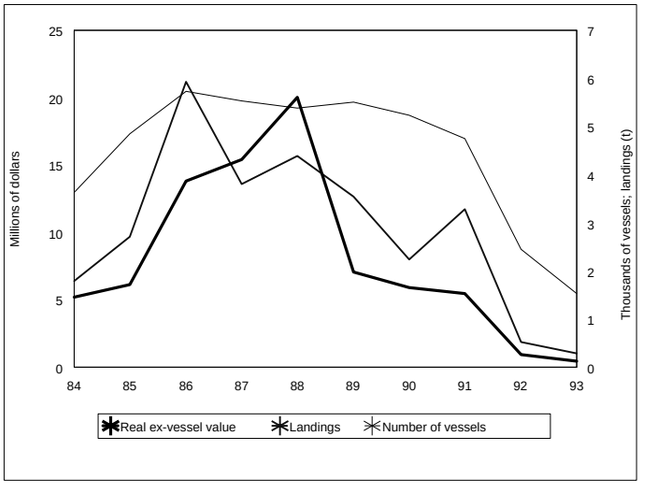


Figure 4-6
Ex-vessel value, landings, and number of vessels harvesting coho salmon (includes landings of fish caught inside state waters).

length of the 1992 season, proof of overcapitalization in this fishery, as well as further validation that licenses do not provide the proper incentives for using the efficient levels of capital in fisheries. Beginning in 1992, the PFMC spent more than 2 years developing a proposal for introducing a system of ITQ's into this fishery. However, they tabled further consideration of this approach in the fall of 1994, citing concerns over the allocation of resource rents and the magnitude of projected administrative and enforcement costs relative to potential benefits.

Salmon

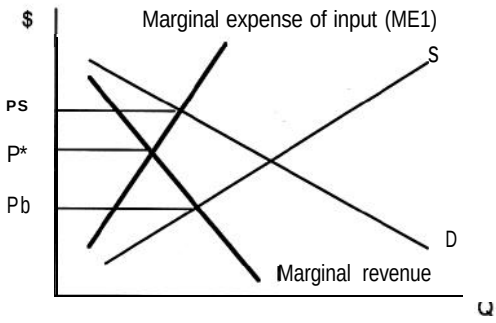
The west coast commercial, nontribal salmon fisheries underwent tumultuous change during 1984-93. This period's high-water marks for landings, price-per-pound, revenue, and average revenue per participant occurred in 1988. Total salmon ex-vessel revenue increased by more than a factor of three between 1984 and 1988 (and by a factor of six for salmon caught within the EEZ). However, by 1992-93, landings and prices had both fallen to levels below those observed in 1984. The number of vessels earning the largest share of their income from salmon fishing rose from less than 4,900 in 1984 to 6,500 in 1988, and has since fallen to just over 3,300. Figures 4-5, 4-6, and 4-7 display the commercial, nontribal salmon landings, ex-vessel value, and number of vessels fishing for chinook, coho, and other salmon species, respectively.

A variety of factors have contributed to the instability evidenced by salmon populations in this region over the past 10 years. Foremost among these factors are spawning habitat inaccessibility or degradation, which has accompanied the presence of dams and other land-use practices, and large-scale ocean environmental fluctuations such as the recurrent El Niño phenomenon. Additionally, the problem of migrational mortality at dam sites has been exacerbated by cyclical drought conditions occurring throughout the Pacific Northwest.

The reductions observed in salmon escapement since 1988 have led to the listing of four stocks as endangered (Snake River sockeye salmon and Sacramento River winter-run chinook) or threatened (Snake River spring/summer chinook and Snake River fall chinook), under the provisions of the Endangered Species Act. These listings and the potential for additional stocks to be listed have had considerable impact on the management and utilization of other, healthier salmon stocks as well as some groundfish fisheries.

The Seafood Processing Sector

Over the past decade, relatively little comprehensive research has been undertaken



Bi-lateral monopoly: one seller (fishing vessel association) and one buyer (monopsony ex-vessel fish buyer). Price will be negotiated and will fall somewhere between the monopoly price (Ps) and the monopsony price (Pb). Economic theory states that the amount traded would be less than that traded under perfect competition, but perfect competition is unlikely in the context of an open access fishery.

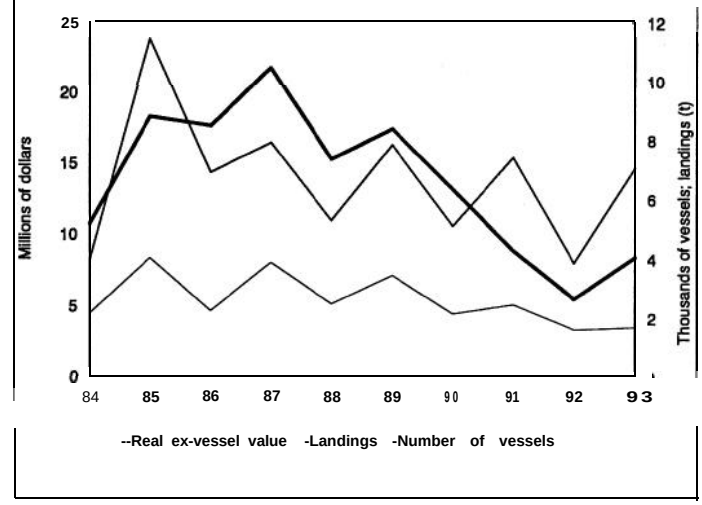


Figure 4-7
Ex-vessel value, landings, and number of vessels harvesting other salmon.

regarding the west coast seafood processing sector. Current management issues relating to the PFMC's goal of maintaining year-round groundfish fishing opportunities, in the face of lower stocks and greater effort, suggest the need for a more in-depth examination of processor activities. Seafood processing on the west coast involves several types of firms which vary widely in terms of the range of products they produce, their relative dependence on imported vs. local raw seafood input, and other products produced within the same conglomerate. This section provides a picture of the major components of the curren (1991-93) west coast processing industry and describes the major changes that have occurred over the decade from 1984 to 1993.

Processors that buy fish directly from west coast vessels can be divided into five rather distinct groups: canneries (tuna, pet food, salmon, squid, sardines), at-sea Pacific whiting processors, sea urchin and sea cucumber processors, Pacific herring processors, and combination processors handling salmon, crab, shrimp, groundfish, pelagic fish , squid, and sometimes sea urchins or herring. There is some overlap among these categories, but most fish buyers of any significance clearly fall into one of the groups. In addition to these processors, there are those that import fish or fish products (surimi) for further processing (e.g., into breaded sticks and portions or imitation crab meat), but are not reflected in the landings database because they do not buy directly from vessels landing on the west coast.

Almost all west coast landings of shrimp, crab, salmon, and groundfish (accounting for 58%of the ex-vessel value of all marine fish landed on the west coast in 1993), were processed by multi-species, multi-product processing plants. The species mix handled by these plants has not changed much over the last ten years, except for the large expansion of Pacific whiting landings in Oregon beginning in 1991. In 1993, the five largest processors of this type accounted for 45% of the shrimp, crab, salmon, and groundfish landings. Most of the significant ports have two or more processing firms purchasing these species from vessels, either at processing plants or buying stations. The fish purchased at buying stations are trucked to other sites for processing. The existence of localized monopsony power is a definite possibility, but has not been investigated. In the event it does exist, it is probably largely offset by the fishing vessel associations active in price negotiations with processors throughout the coast.

Figure 4-8 provides an annual overview of the number of licensed buyers who purchased landings on the west coast, along with the average tons purchased per buyer and average real ex-vessel value of landings per buyer. The complete list of buyers includes a very large number who do not represent the core of the processing industry. For purposes of identifying the general size of the core group, a threshold of 25 t was set, and the average tons purchased and average real value of

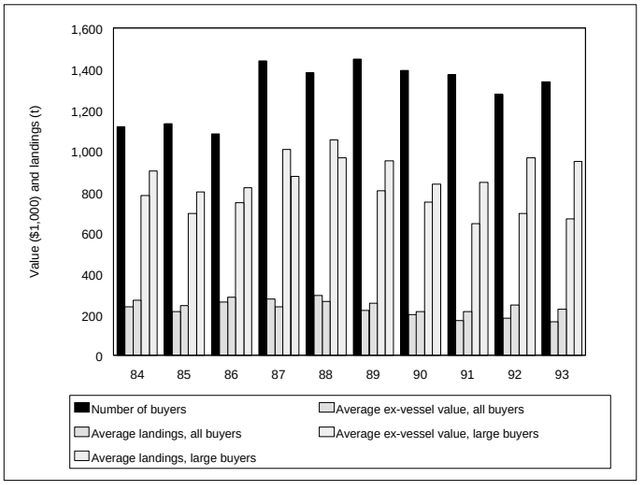


Figure 4-8
Average ex-vessel volume and value of all west coast buyers vs. "large" buyers ("large" refers to those buyers who receive more than 25 t).

Table 4-2
West coast processed fishery product output per employee, 1984-93[1].

Year	Average no. of employees	Output (t)	Output (t) per employee	Real value of output ($1,000)	Real dollars per employee
1984	9,513	304,620	32.0	707,043	74,324
1985	7,743	205,027	26.5	483,407	62,431
1986	8,288	195,335	23.6	590,749	71,278
1987	8,547	233,051	27.3	773,874	90,543
1988	9,156	378,051	41.3	984,239	107,497
1989	9,343	383,898	41.1	965,927	103,385
1990	10,817	351,042	32.5	1,100,975	101,782
1991	11,882	415,846	35.0	1,328,200	111,783
1992	11,562	403,627	34.9	1,136,024	98,255
1993	11,145	447,785	40.2	1,201,386	107,796

[1]Source: NMFS Annual Survey of Processed Fish Products.

landings per buyer was calculated. These trends are also shown in Figure 4-8. Average annual real ex-vessel purchases by those buyers receiving at least 25 t ranged from $647,000 to $1,054,000 over the period 1984-93.

There were 315 buyers in the core group in 1993, or about 24% of the total number of licensed buyers. However, this core group accounts for 99% of the fish landed, by weight. The core group of buyers is composed primarily of fish processors, although many processing firms have multiple buyer codes. After combining all buyer codes associated with the same parent firm, the top 10% of firms in terms of sales (129 firms) account for 87% of the ex-vessel value of all fish landed on the west coast in 1991.

Table 4-2 shows average employment, output in metric tons, real revenues, and output per employee for west coast processors. Because of variations in the response rate from year to year in the NMFS survey, the industry-wide levels of employment and output are not always reliable. However, the output/employee ratios are not as sensitive to response rates. These figures indicate a modest upward shift in output per person over the last decade.

The most significant development in the west coast fish processing industry over the last decade has been the growth of domestic production of analog products (e.g., imitation crab meat) from surimi. The surimi used is mostly produced from Alaska pollock, by floating and shorebased processors in Alaska, although a small number of processors use surimi produced from Pacific whiting (hake). The revenues from reported analog production on the west coast grew from zero in 1984 to $135.7 million in 1993. Revenues from west coast production of surimi during that period grew from zero to $29.1 million. It is not known how much

In addition to the NMFS Annual Survey of Processed Products (described in this report's Introduction and Overview), the west coast has a second source of data with which to analyze the structure of its processing industry. This is the fish landing receipt system managed by the three west coast states and integrated into the Pacific Fisheries Information Network (PacFIN) data retrieval system. These data consist of records of each sale of fish by fishing vessels to processors or other firms or individuals. Fish buyers must be licensed unless they are consumers buying directly from fishing vessels, in which case the vessels must be licensed for over-the-side sales. Each licensed buyer and each vessel licensed to sell over-the-side has a buyer code that is recorded on the fish landing receipt and is incorporated into the PacFIN data base. This data reporting system has more detailed information on the species of fish and where fish were caught than does the NMFS survey. The PacFIN database also has the advantage of being mandatory, so that response rates may be presumed to be high and relatively constant. However, it contains no prices or quantities of output. Furthermore, not all west coast fish buyers are processors, and much of the fish processing activity on the west coast uses fish that are shipped from other regions and therefore is not reflected in PacFIN data.

of this surimi was used in west coast analog production.

Alaska pollock is also used by west coast seafood processors for breaded and battered products. These products have been a substantial part of fish processing activity throughout the decade, although they have not shown the consistent, rapid growth of analog products. The real wholesale value of reported output of breaded and battered products on the west coast has fluctuated substantially, with a low in 1989 of $75.6 million and a high in 1993 of $131 million.

The period 1984-93 also saw very significant changes in the processing of Pacific whiting. In 1984, the total Pacific whiting harvest was approximately 115,000 t, of which 2,700 t were processed on shore by U.S. processing firms. The remaining 112,300 t were processed by foreign floating processors engaged in joint ventures or directed foreign fishing. By 1993, all harvest was processed by U.S. firms, with 30% processed in onshore plants and the remaining 70% processed at sea.

West coast fish canning has been dominated throughout the past decade by southern California tuna and pet food canners. The principal sources of fish have been albacore from west coast ports, light meat tuna landed in California, light meat tuna shipped in from areas outside the west coast, and mackerel landed in California. Total revenue from fish products reported by canners responding to the NMFS Annual Survey (including all the large tuna canners) dropped from $267.3 million in 1984 to $73.2 million in 1986. This precipitous decline was due primarily to the closing of two major tuna canneries in California. After reaching its lowest point in 1986, the coastwide reported value of canned fish production steadily rose to a high of $306.3 million in 1993. This was due mostly to a substantial increase in canned tuna production and a very large increase in production of canned pet food from fish products. [See the west coast fisheries spotlight article for a discussion of the canned tuna industry.]

Processing of shrimp has grown rapidly since 1984, with most of the growth taking place in California. West coast landings fluctuated during the decade, but accounted for less than 25% of the revenue generated from shrimp products by 1993. The bulk of the increase comes from processing imported shrimp.

Processing of sea urchin roe for export to Japan has grown rapidly during the decade; the NMFS survey data indicate an increase from no production in 1986 to $73.7 million worth of production in 1993. However, it is not known how accurately the survey reflects what was actually happening in this segment of the processing industry. In 1991, only 20 responding firms indicated any output from sea urchins, but PacFIN data indicate that 99 firms bought sea urchins from Washington, Oregon, and California vessels. Sixty-five sea urchin buyers, accounting for 93% of sea urchin ex-vessel value, purchased almost nothing but sea urchins. Four of these were among the top 25 buyers of fish and shellfish landed on the west coast. The high degree of specialization of these processors may be due to the fact that the product is exported to the very discriminating Japanese market.

The Trade Sector

Due to the way trade data are collected (by Customs district), information on Washington, Oregon, and Alaska imports and exports are combined into one Pacific Northwest report. See Chapter 3, the Alaska regional report, for a discussion of that sector.

The Recreational Sector

Summary Statistics

This section presents an overview of the marine recreational fishing sector in California, Oregon and Washington[1]. About 3.1 million marine anglers made 11.1 million fishing trips and landed 28.1 million fish annually during 1983-89 on the Pacific coast (Fig. 4-9—4-12). The distribution of anglers among southern California, north-

[1]All estimates of nonsalmon harvest and effort contained in this report were obtained from the Marine Recreational Fishery Statistics Survey (MRFSS), described in the national overview section. The MRFSS was conducted annually on the Pacific coast through 1989, discontinued during 1990-92, and resumed in 1993. When the survey resumed, it did not provide complete coverage of the entire Pacific coast fishery; i.e., estimates of effort and harvest for all modes in Washington and estimates of harvest for charter boat mode in northern California are not available for 1993. Estimates of salmon harvest and effort were obtained from the PFMC. Even though these estimates are available as a continuous time series, they are presented in this report only for those years in which estimates of nonsalmon harvest and effort from the MRFSS are also available.

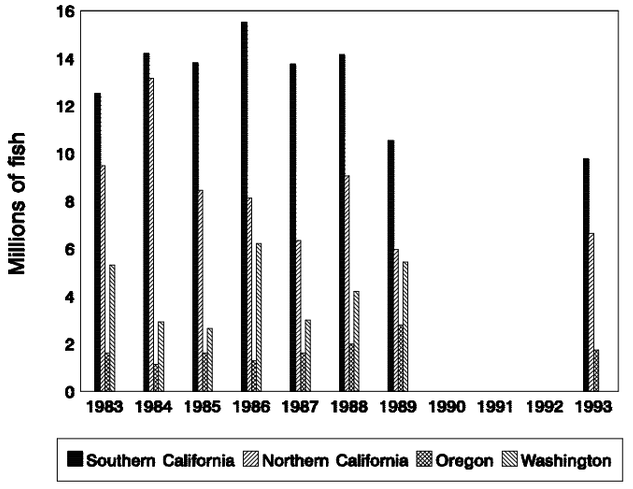


Figure 4-9
Estimated number of fish harvested by West coast recreational fishermen, by state.

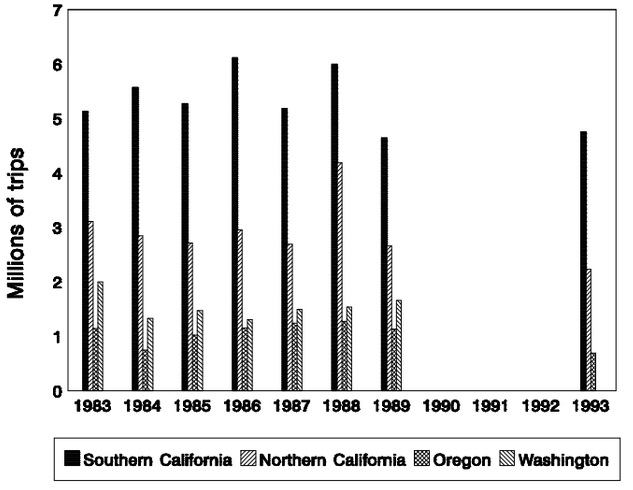


Figure 4-10
Estimated number of recreational fishing trips on the West coast, by state.

ern California, Oregon, and Washington (47%, 30%, 10%, and 13%, respectively) closely approximated the geographic distribution of fishing trips (49%, 27%, 10%, 14%) and total harvest (48%, 31%, 6%, 15%). A comparison of the average annual number of anglers during 1983-89 with the number of anglers in 1993 suggests a general decline in angling participation in recent years, at least in California and Oregon. The average annual number of angler trips during 1983-1989 was also consistently higher than the number of angler trips in 1993 for all modes in California and Oregon, with the notable exception of charter boat trips in southern California.

Total annual harvest also declined from 1983-89 to 1993 for all modes in California and Oregon, except for private boats in northern California and charter boats in Oregon. This decline in harvest may be due to shifts in the distribution of trips among target species as well as a decline in effort. For instance, since catch rates tend to be substantially higher for rockfish trips than salmon trips, an increase in the proportion of total trips targeted at rockfish may result in an increase in total harvest, even if total effort remains the same. The distribution of average annual harvest among fishing modes (35% shore, 30% charter boat, and 35% private boat) differed somewhat from the distribution of trips (39% shore, 16% charter boat, and 45% private boat) during 1983-1989. The disproportionate representation of charter boat harvest relative to trips indicates higher catch rates for charter boats relative to the other modes.

The species composition of harvest tends to vary among areas and fishing modes. For instance, salmon are rarely caught in southern California, while sea bass and mackerel/tuna are rarely caught anywhere else on the Pacific coast except southern California. Surfperch is commonly caught from shore, while rockfishes constitute a major component of harvest in the boat-based modes (Tables 4-3a–3c). The importance of a species to the fishery in terms of the number of trips is not necessarily reflected in its contribution to total harvest. For instance, salmon was the primary target on 26% of all charter boat trips in northern California during 1983-89 but comprised only 5% of total annual charter boat harvest in those years. This same disproportionality between salmon trips and salmon harvest occurs in other areas and modes as well (Table 4-4). In Oregon, the proportion of total charter boat trips targeted at salmon declined from 45% to 14% and the contribution of salmon to total charter boat harvest declined from 16% to 2% from 1983-89 to 1993. Similarly, the proportion of total private trips targeted at salmon declined from 29% to 16% and the contribution of salmon to total private boat harvest declined from 29% to 9% from 1983-89 to 1993. However, no similar trend was observed for private boat fishing in northern California.

West coast sport fishing boats at llWaco, Wash. (NMFS photo by Steven Freese).

During 1983-89, non-residents contributed more to the angling population than to angler trips, averaging 1.5 trips per year, compared to 4.1 trips per year for resident anglers. About 6% of shore trips, 16% of charter boat trips, and 5 % of private boat trips on the Pacific coast during 1983-89 were made by non-resident anglers.

Expenditures and Economic Value

Anglers spend about $848.6 million annually for sport fishing on the Pacific coast-about 43 % for equipment and 57% for trip-related expenditures (Table 4-5). Total equipment expenditures are based on the annual average number of resident anglers during 1983-89 and on available estimates of per capita equipment expenditures (U.S. Fish and Wildlife Service and U.S. Bureau of the Census, 1993a, b, c). Equipment expenditures by nonresident anglers are not attributed to Pacific coast fishing, since these anglers do most of their fishing elsewhere and are more likely to purchase equipment in their home states.

Total trip expenditures of $486.1 million are based on the average annual number of fishing trips made during 1983-89 and on available estimates of expenditures per trip. The level of detail of these estimates varies by region and is determined by the level of detail provided by available per trip estimates. Thus total trip expenditures are broken down by fishing mode and residency of angler for southern California, by fishing mode for northern California, and by residency for Oregon and Washington.

Aggregate angler consumer surplus (ACS) cannot be estimated for the entire Pacific coast, since estimates of consumer surplus per trip are available only for selected areas, modes, and species.

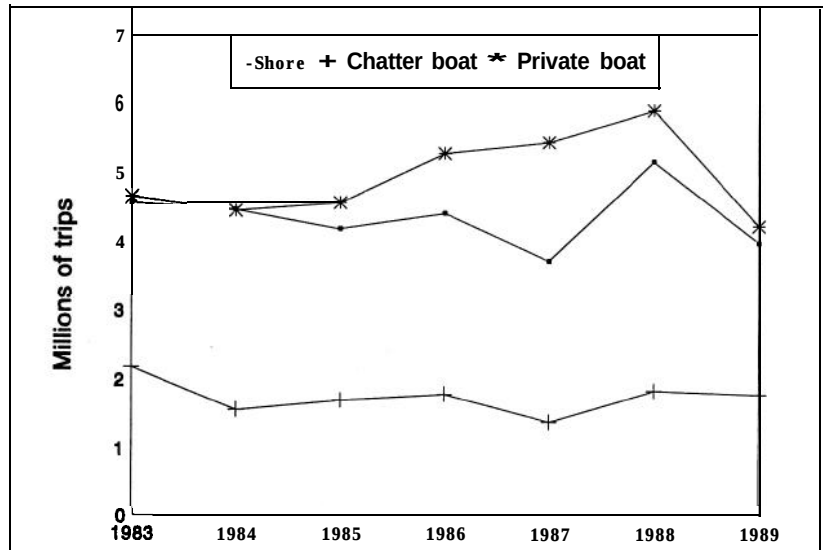


Figure 4-11
Estimated number of recreational fishing trips on the West coast, by mode.

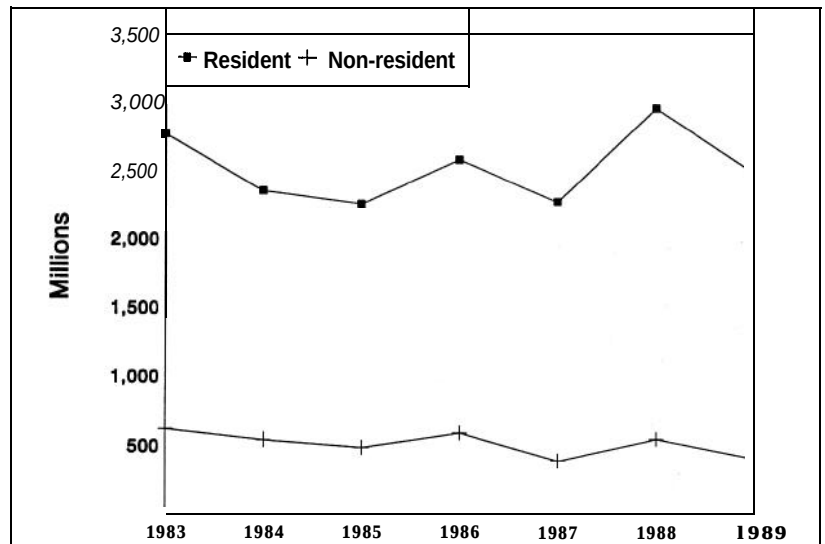


Figure 4-12
Estimated number of resident and nonresident anglers on the West coast.

The available estimates, however, do suggest that ACS is a significant component of total willingness-to-pay (WTP) for recreational fishing experiences (WTP is the sum of consumer surplus and expenditures). For instance, ACS per trip in southern California has been estimated at $79.65 for charter boat trips and $27.07 for private boat trips (Hanemann et al., 1989); these values are comparable in magnitude to expenditures per trip for southern California ($68.64-$97.32 for charter boat trips and $50.44-$94.82 for private boat

Table 4-3a
Average annual 1983-89 distribution of finfish harvest in shore mode in California, Oregon, and Washington, by species group and region[1].

Species group	Southern California	Northern California	Oregon	Washington
Croaker	18%	4%	0%	0%
Surfperch	15%	23%	31%	12%
Smelt	3%	41%	21%	60%
Mackerel/tuna	30%	1%	0%	0%
Rockfish	10%	9%	13%	7%
Silversides	7%	4%	0%	0%
Herring	0%	4%	9%	6%
All other species	18%	14%	26%	16%

[1]Columns may not add up to 100% due to rounding of data.

Table 4-3b
Average annual 1983-89 distribution of finfish harvest in charter boat mode in California, Oregon, and Washington, by species group and region[1].

Species group	Southern California	Northern California	Oregon	Washington
Sea bass	17%	0%	0%	0%
Mackerel/tuna	28%	4%	0%	0%
Rockfish	35%	67%	56%	38%
Salmon	0%	4%	15%	12%
Smelt	1%	2%	9%	17%
Cod/hake	0%	0%	1%	20%
All other species	19%	22%	20%	13%

[1]Columns may not add up to 100% due to rounding of data.

Table 4-3c
Average annual 1983-89 distribution of finfish harvest in private boat mode in California, Oregon, and Washington, by species group and region[1].

Species group	Southern California	Northern California	Oregon	Washington
Sea bass	18%	0%	0%	0%
Mackerel/tuna	27%	3%	0%	0%
Rockfish	31%	60%	39%	28%
Salmon	0%	3%	27%	6%
Flatfish	3%	7%	1%	12%
Shark	1%	2%	0%	13%
Cod/hake	0%	0%	0%	23%
Croaker	9%	10%	0%	0%
Surfperch	1%	3%	13%	1%
All other species	11%	12%	21%	17%

[1]Columns may not add up to 100% due to rounding of data.

trips). Multiplying the number of angler trips for charter and private boats by their respective per trip ACS yields a total value of recreational fishing in southern California of $173 million (which excludes the value of shore-based trips).

Regulations

State regulations generally require that anglers who have reached a specified age (16 years in California, 14 years in Oregon, and 15 years in Washington) obtain a state angling license (CDFG, 1994; ODFW, 1995; WDFW, 1994). Each state also imposes restrictions on gear, seasons and areas fished, as well as size and bag limits. Some of these restrictions apply to all marine fishing, while others are species- or area-specific.

Management Issues

Most of the major management issues faced in the three Pacific coast states involve allocation of nearshore fishing opportunities between sport and commercial fishermen. These issues have typically taken the form of direct allocation or management measures which have an indirect allocative effect. Some of the states' actions have involved consultation with the PFMC to determine consistency of state regulations with the Federal Groundfish Management Plan, and have generated considerable discussion and controversy at the PFMC as well as at state levels.

In 1990, California voters passed Proposition 132, which banned the use of commercial set nets to harvest rockfish in state waters. In the same year, concerns regarding depletion of black rockfish prompted Washington to close major charter boat fishing areas to commercial jigboats and reduce the sport bag limit for rockfish. Oregon enacted similar measures in 1993, and Washington reduced its rockfish bag limit a second time this year. In 1988, the Washington Legislature banned commercial trawling in urbanized areas, and extended that ban in 1994 to other areas as well. Washington is now considering a ban on all commercial bottomfishing within its 3-mile jurisdiction.

Literature Cited

CDFG.
1994. California Sport fishing regulations. 1994-1996. Calif. Dep. Fish Game, Sacramento.

Hanemann, W. M., T. C. Wegge, and I. E. Strand, Jr.
1989. Development and application of a predictive model to analyze the economic effects of species availability.

ODFW.
1995. Oregon sport fishing regulations. Oreg. Dep. Fish Wildl., Portland.

U.S. Fish and Wildlife Service and U.S. Bureau of the Census.
1993a. 1991 National survey of fishing, hunting, and wildlife-associated recreation—California. U.S. Gov. Print. Off., Wash., D.C.
1993b. 1991 National survey of fishing, hunting, and wildlife-associated recreation—Oregon. U.S. Gov. Print. Off., Wash. D.C.
1993c. 1991 National survey of fishing, hunting, and wildlife-associated recreation—Washington. U.S. Gov. Print. Off., Wash., D.C.

WDFW.
1994. Salmon, shellfish, bottomfish sport fishing guide. May 1, 1994 thru April 30, 1995. Wash. Dep. Fish Wildl., Olympia.

Table 4-4
Average 1983-89 and 1993 contribution of salmon to total trips and total catch in northern California, Oregon, and Washington, by fishing mode and area.

	Northern California		Oregon		Washington	
	Charter boat	Private boat	Charter boat	Private boat	Charter boat	Private boat
Percent of total trips targeting salmon						
1983-89	26%	9%	45%	29%	43%	6%
1993	24%	10%	14%	16%	N.a.[1]	N.a.
Percent of total harvest consisting of salmon						
1983-89	5%	3%	16%	29%	17%	6%
1993	N.a.	2%	2%	9%	N.a.	N.a.

[1]N.a. = not available.

Table 4-5
Average annual 1983-89 expenditures for marine recreational fishing on the Pacific coast.

Area and status	Shore	Charter boat	Private boat	Subtotal	Equipment	Total
S. CA resident	38,868	94,636	103,762	237,267	131,399	368,667
S. CA nonresident	8,865	12,139	9,536	30,541		30,541
S. CA total	47,733	106,775	113,298	267,808	131,399	399,208
N. CA resident					83,675	
N. CA nonresident						
N. CA total	41,166	19,612	56,654	117,432	83,675	201,108
OR resident				33,556	37,612	71,169
OR nonresident				5,550		5,550
OR total				39,106	37,612	76,719
WA resident				55,244	109,811	165,055
WA nonresident				6,470		6,470
WA total				61,714	109,811	171,525
Pac. coast resident					362,499	
Pac. coast nonresident						
Pac. coast total				486,062	362,499	848,560